How many dimensions is space?

Bezverkhniy Volodymyr Dmytrovych.

Ukraine, e-mail: bezvold@ukr.net

It is usually considered that space has three dimensions (x, y, z). But, it can be shown using quantum mechanics (quantization) that we live in a space with an initial dimension of two, and dimension three is a consequence, and nothing more. This follows from the very concept of "quantization". Moreover, it follows purely mathematically...

If space had dimension three, then quantum mechanics would simply stop working, since quantization would cease to exist, this becomes clear if we consider the addition operation. Consider the general case:

$$x^n + y^n = z^n$$

Now consider addition for n = 1.

$$x + y = z$$

But, it is easy to see that in this case there is no quantization, since when adding two arbitrary numbers, we always get the third definite number. This case can be considered as "quantization" in space with dimension 1.

Let's move on to n = 2. In this case, we will have quantization in its pure form, since we will get an expression that will be satisfied only by certain triples of numbers (Pythagorean triples of numbers).

$$x^2 + y^2 = z^2$$

For example:

(3, 4, 5) (5, 12, 13) (8, 15, 17) (7, 24, 25)

(20, 21, 29) (12, 35, 37) (9, 40, 41) (28, 45, 53)

(11, 60, 61) (16, 63, 65) (33, 56, 65) (48, 55, 73)

(13, 84, 85) (36, 77, 85) (39, 80, 89) (65, 72, 97)

There are countless numbers of such triplets that can be generated (according to Euclid's formula), but what is especially important for us is that addition can be realized only in certain cases. That is, for n = 2 we have the case of "pure quantization" - when quantization (read "addition") is allowed only for certain numbers. Moreover, for n = 2, the two-dimensional space is quantized, since this is actually the addition of the areas of the squares: we have two squares x^2 and y^2, which, when added, form the third square.

You can set the general case, then we will have two spheres with radii x and y, and when adding these spheres (their areas), we get a third sphere with a radius z. This follows from the addition of the areas of the spheres ($4 * \pi * R^2$).

$$4 * \pi * x^2 + 4 * \pi * y^2 = 4 * \pi * z^2$$

And when shortened, we get our expression:

$$x^2 + y^2 = z^2$$

It is even more important that in the last expression the numbers x, y and z are rational numbers (in Pythagorean triples, the numbers are integers). The rationality of numbers follows from the very concept of addition (quantization), since we take certain two spheres, and we get a third sphere ("without a remainder"). That is, the areas of the spheres, and their radii, must be comparable. And a rational number is exactly the number that is given by commensurate segments (a / b). If we turn to quantum mechanics, then it is easy to understand that when quantizing energy (or angular momentum, etc.), we actually have the addition of two portions of energy: for example, an atom absorbs a photon, and as a result we get a third portion of energy. These portions of energy must have a final, measurable value. Moreover, all three portions of energy must be commensurate.

If the radius of the sphere were an irrational number, then this would mean that the radius of such a sphere is virtually impossible to measure, since an irrational number is indeed an infinitely long number. Let us recall Zeno's aporia "Achilles and the Turtle": since Achilles will never be able to catch up with the turtle, so we will never be able to actually measure the radius of the sphere (with absolute precision), which will be given by an irrational number. Everything is the same: an irrational number will always be slightly longer than we measured! Moreover, irrational numbers, by definition, are numbers that express "incommensurability", and the radii of the spheres during quantization must be commensurate (quantization is the addition of areas).

Therefore, in quantum mechanics, quantization will always express the addition of commensurate objects, that is, objects that will be given by rational numbers. It follows from this that three-dimensional space, and spaces of higher dimension ($n \geq 3$), cannot be quantized in principle, since the equation:

$$x^n + y^n = z^n$$

for $n \geq 3$ has no solutions in rational numbers (when x, y, z are rational numbers).

Note that the impossibility of quantizing space with dimension three, Zeno showed in his aporia "Achilles and the Turtle".

From the above it follows that since quantization in quantum mechanics is an experimental fact (of energy, angular momentum), then our world at the fundamental level has a dimension of two. Obviously, space with dimension three is a consequence of a certain internal rotation of such two-dimensional objects.

Let us recall that the spin of elementary particles expresses precisely a certain internal rotation of elementary particles. Therefore, to such two-dimensional objects we refer elementary particles (electron, photon, quark, etc.), which, due to the wave-particle duality, and "give birth" to our space-time continuum.

Finally, we note that if at the fundamental level the space had dimension 1 (for example, strings), then quantization would be impossible, since when adding up any portions of energy, we will always get the third portion of energy. And quantization expresses the addition of only certain portions of energy (not all). Therefore, such a world would not be structured, since there is no discreteness.

P.S. The essence of quantization is the discreteness of the values of certain quantities (energy, angular momentum). For example, Planck's formula ($E = h * \nu$) expresses precisely the quantization of energy, and it was with this formula that the era of quantum mechanics began in 1900.

But, with quantum interactions, these quanta are simply summed up, and as a result we get other quanta.

$$A + B = C + D$$

For example, an atom absorbs a photon, and goes into an excited camp:

$$A + B = C$$

The fact that in quantum interactions, in fact, the addition of certain quanta allows us to go to the general case according to the corresponding formula.

$$x^n + y^n = z^n$$

The case for $n = 2$ is very illustrative: the addition of areas, that is, here is a pure quantization of two-dimensional space.

$$x^2 + y^2 = z^2$$

Well, then, it's a matter of technology... Moreover, very pleasant :) ...